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SOILS MAP OF THE ARCTIC (POCHVENNAIA KARTA ARTIKI),(U)
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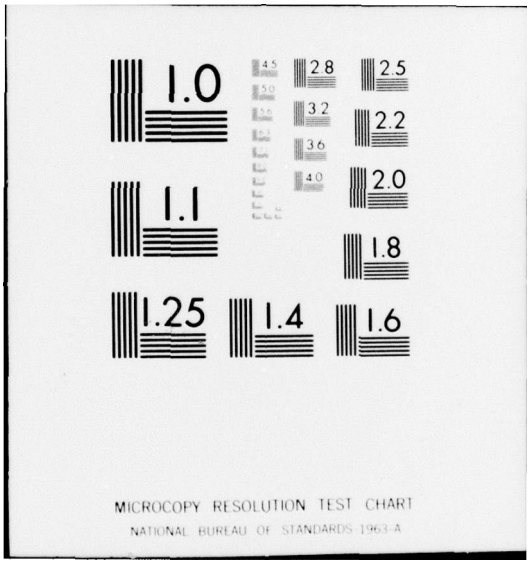
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SOILS MAP OF THE ARCTIC

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20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

A soil map of the Arctic, including the arctic and tundra regions of the Northern Hemisphere and the parts of the taiga zone that are adjacent to them, has been compiled at a scale of 1:10 000 000. The map shows the prevalent soils, their zonal and facial peculiarities, and the structure of the soil cover. The composition of the soil cover and microcombinations (complexes and nanocomplexes of soils) are determined mainly by bioclimatic conditions. Seven genetic- geometric forms of microcombinations (cracknanopolygonal,

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knolls, formed by cryoturbations, etc.) have been singled out. The meso-structure of the soil cover (combinations and mosaics) is conditioned mainly by the lythological and geomorphological peculiarities of the area. Fourteen genetic- geometric forms of mesostructures (linear-dendritic erosional, rounded-spotted depressional, etc) have been established. Division of the area into soil regions, drawings of soil profiles and complexes, and analytical data on soils complement the map.

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SOILS MAP OF THE ARCTIC

Moscow POCHVY MIRA (Soils of the World), in Russian, Transactions of the Tenth International Congress of Soil Science, Vol 8, 1974, pp 44-49

/Article by Ye. N. Ivanova, V. D. Vasil'yevskaya, I. V. Ignatenko, N. A. Karavayeva, I. T. Liverovskaya, I. S. Mikhaylov, Ye. M. Naumov, V. O. Targul'yan and V. M. Fridland, Soils Institute imeni V. V. Dokuchayev, Institute of Geography, USSR Academy of Sciences, Moscow State University, Institute of Agrochemistry and Soil Science USSR Academy of Sciences, and Institute of Biological Problems of the North, Far Eastern Scientific Center USSR Academy of Sciences/

/Text/ The soils map of the Arctic includes the arctic and tundra regions of the northern hemisphere and adjacent parts of the taiga zone. The map legend includes 20 categories of soils and 26 categories of soil complexes. The soil legend takes in the following morphogenetic groups.

I. A group of gleyey undifferentiated soils which are clayey loam-clayey or stratified in mechanical composition with overmoistened, gleyized profiles of the type $A_0(A_I)$-B (G)-C_g and a permafrost water-impermeable layer, which includes: 1) tundra humus gleyized and gleyey, tundra typical gleyey (with a thin underlying layer), tundra humus-gleyey and gleyized, tundra peaty and peaty-gleyey (swamp-tundra); 2) gleyey-permafrost-taiga and taiga gleyey undifferentiated soils.

II. Group of nongleyized nonpodzolized and podzolized soils ("subbrowns" in the Targul'yan classification) with soils light in mechanical composition and a well-drained profile of the type $A_0(A_I)$-$B_{h,hf}$-C which includes: 1) tundra illuvial-humus (with separation into illuvial with little humus, illuvial with humus and illuvial with much humus); 2) taiga

and scrub illuvial-humus (dry peaty); 3) taiga acidic nonpodzolized; 4) tundra illuvial-humus podzolized (with presence of lightened and illuvial horizons).

III. Group of nongleyized soils with a slightly leached calcareous or saline profile of extremely cold, cryoarid and semiarid regions (high Arctic and northern part of central Yakutia), including: 1) arctic desert soils, neutral and slightly leached, with salts and carbonates; 2) arctic humus soils (neutral-slightly acidic); 3) taiga straw-colored (slightly unsaturated); 4) taiga-steppe (illuvial-calcareous).

IV. Group of gleyey differentiated and podzolized soils, including: 1) tundra and taiga gleyey and gleyized differentiated (without a lightened horizon, but with efflux of silt and R_2O_3); 2) tundra gleyey podzolized (presence of discontinuous lightened A_0A_2, A_1A_2, A_2B is combined with the efflux of silt and R_2O_3.

V. Group of podzolic clayey loam-clayey soils with impeded drainage of the profile, including: 1) gleyey-podzolic soils (with gleyey A_2 and B_1); 2) podzolic-gleyey or swampy-podzolic (with gleyey characteristics of the entire or the greater part of the profile); 3) podzolic (without gleyey characteristics, but with evidence of seasonal reduction processes).

VI. Group of illuvial-humus podzols with well-drained nongleyey profile (with their subdivision into those with little humus, humus and much humus). Also discriminated are podzols of the illuvial-humus gleyized and gleyey types on light rocks with additional moistening.

VII. Group of swamp soils, including: 1) swampy (peaty-, boggy-, and silty-gleyey lowland types); 2) high moors.

VIII. Group of cryogenic and corrosion soils, including: 1) soils in spots without vegetation; 2) dry peaty soils of hummocks; 3) soils of hummocky peat bogs; 4) jointed peaty soils; 5) soils of baydzherakhi landscapes (hillocks remaining after deglaciation).

IX. Alluvial and marsh soils.

X. Group of soil and rock categories (for rocky and sandy areas), including: 1) outcrops of dense rocks, primitive-humus -gravelly soils; 2) primitive soils on unconsolidated rocks.

A general characteristic of the soil cover of the Arctic is its complexity, associated with manifestation of permafrost

processes, thermokarst, solifluction, heaving, snow and wind erosion, nival effects, etc. The soil cover consists of combinations of geometrically different complexes having a definite association with facies, zones and subzones.

The complex structure of the soil cover in the Arctic is reflected in the map legend in two special sections: soil complexes (microcombinations) and soil combinations and mosaics (mesocombinations). It was possible to define 26 complexes of soils which were combined into seven groups: jointed-nanopolygonal, sporadically jointed-spotty (with outflows along the joints), sporadically spotty (heavings) heaved-hummocked, macroblock and macroblock nanohummocked and nanopolygonal, solifluction linear and spotty, polygonal-ridged, rocky-polygonal. The most diverse are the jointed-nanopolygonal (six groups) and heaved-hummocked (seven groups) complexes.

The mesocombinations are combined into twelve genetic-geometrical forms (linear-dendritic erosional, rounded-spotty swell and swale, banded-lenticular, floodplain-delta, and others). The first part of the name characterizes the geometrical peculiarities of the mesocombination and the second -- the causes of their appearance.

The following cartographic system for representing the soil cover was adopted:

1. Genetic-geometrical form of mesocombinations, reflected in the index by a Roman numeral which is placed at the beginning of the index.

2. The index for composition of the soil cover includes digital indices (for homogeneous components of the soil cover) and digital indices (for the complexes). These indices are arranged in sequence from the more commonly occurring components to the less commonly occurring. If the components form a combination, they are combined with a "+" sign, or if they form a mosaic -- with an "x" symbol.

3. A defined area is given the color of the predominant soil. If there is predominance of a soil forming continuous areas, the color is made uniform; if a complex plays the leading role, the area is covered with a colored screen whose form characterizes the group of the complex, whereas the color characterizes the soil predominating in the key complex.

The mechanical composition of the soils is represented by black shading.

Mountainous areas are designated using a light-colored oblique shading.

As an example we will decode the following complex index: III-5+19+38 -- rounded-spotty swell-and-swale combination (number III and the symbols "+" between components), consisting of jointed-nanopolygonal complexes of tundra humus gleyey soils, spots and jointed-peaty soils (number 5), jointed-nanopolygonal complexes of tundra boggy- and peaty-gleyey (swamp-tundra) and jointed-peaty (number 19) and homogeneous areas of swampy low-place soils (index 38).

The area of the Arctic with respect to the nature of the soil cover is divided into four zones: arctic desert, arctic, tundra and taiga. The desert-arctic and arctic zones are internally relatively homogeneous with respect to bioclimatic conditions. The differences in the soil cover within the zones are associated with lithological-geomorphological conditions. Jointed-nanopolygonal complexes are widespread: first, where there is widespread occurrence of calcareous and saline soils one can observe arctic desert, arctic humus and swampy arctic nongleyized soils, second, there are those where one can observe arctic humus soils, saline soils, and swampy arctic nongleyized and gleyey soils. The tundra zone with respect to the nature of the soil cover is divided into three subzones (arctic, typical and southern) and the following facies, differing with respect to climate, lithological-geomorphological conditions and history of development of the territory: I. Oceanic - nonpermafrost - Scandinavia, Kola Peninsula (mountains-plains, sandy-gravelly); II. Temperate - continental permafrost - northern European USSR (plains sandy-clayey loam) and Western Siberia (plains stratified-clayey loam-sandy). III and IV. Continental permafrost - Middle and Eastern Siberia (mountains-plains gravelly-clayey loam), Northern Canada (plains gravelly-sandy). V. Oceanic permafrost - Chukotka and Yukon territories (mountains-plains gravelly-clayey loam).

The soil cover of the arctic tundra is represented by jointed-nanopolygonal complexes on the watersheds and polygonal-ridged complexes in relief depressions. Facies variability is expressed in two modifications of the composition of complexes on clayey loam rocks: moist facies -- tundra gleyey humus, spotty and jointed-peaty soils; continental facies - tundra gleyey humus, spotty soils and jointed-peaty soils. On light rocks one can observe a predominant formation of complexes of tundra illuvial-humus soils and spotty soils.

The soil cover of the remaining tundra subzones and wooded tundra have distinct subzonal and facies characteristics. In facies I and II on the watersheds in all the subzones and on all the rocks there is a predominance of heaved-hummocked complexes.

In facies I only the southern tundra has developed: one can observe heaved-hummocked complexes of tundra gleyey differentiated soils and spotty soils, and on light rocks -- complexes of tundra illuvial-humus podzolized soils and spotty soils.

Facies II. Two types of complexes have developed: on clayey loam rocks -- tundra gleyey soils, spotty soils and dry peaty soils of hummocks, on light rocks -- tundra illuvial-humus and dry peaty soils of hummocks. From north to south the composition of the complexes changes: the first series contains -- typical gleyey tundra soils, gleyey differentiated tundra soils, tundra gleyized podzolized soils; the second series includes tundra illuvial-humus soils, tundra illuvial-humus podzolized soils and podzols.

In relief depressions of all subzones one can observe the development of complexes of hummocky, flat-topped hummocky and ridged swamps permanently wet due to the outflow of ground water. Western Siberia is transitional to continental facies: in it one observes not only tundra gleyey soils, but also tundra gleyey humus soils; in addition to heaved-hummocked soils there is widespread occurrence of sporadically spotty and hummocked-heaved complexes, polygonal-ridged swamps are encountered in the more southerly subzones.

Facies III and IV. On the watersheds on all rocks there is a predominance of jointed-nanopolygonal complexes of tundra gleyey humus and tundra gleyey humus soils, tundra illuvial-low humus, jointed peaty soils and spotty soils. In relief depressions one finds polygonal-ridged swamp complexes.

Facies V. On the watersheds on clayey loam rocks one finds sporadically jointed-spotty complexes of peaty-gleyey soils and spotty soils, and in relief depressions -- polygonal-ridged complexes. These two structures do not change in composition up to the northern taiga. On gravelly-clayey loam rocks there are heaved-hummocked complexes of tundra gleyey podzolized and differentiated soils and spotty soils. On light rocks there are sporadically spotty complexes of tundra illuvial-humus soils and spotty soils. The composition of the components of the latter two complexes changes from

north to south: on gravelly-clayey loam rocks -- tundra gleyey differentiated soils, tundra gleyey podzolized soils; on light rocks -- tundra illuvial soils with much humus, tundra illuvial-humus podzolized soils, podzols of the illuvial type with much humus.

In the taiga zone in the moist facies the soil cover changes sharply -- it becomes noncomplex (with the exception of swamps) and is represented by combinations: on clayey loam rocks -- gleyey podzolic and podzolic gleyey, on light rocks -- podzols and gleyized and gleyey podzols. In the continental facies of the taiga on clayey loam rocks there is a predominance of jointed-nanopolygonal complexes of gleyey-permafrost-taiga and jointed-peaty soils; on light rocks -- homogeneous areas of taiga acidic nonpodzolized soils. In depressions there are complexes of swamp upland and lowland soils.

In each of the facies the structure of the mesocombinations is determined by lithological-geomorphological conditions.

Structures of the vertical zonation of the Arctic are determined by the latitudinal position of the mountainous country, lithological-geomorphological conditions, slope exposure. The vertical structures are simplest in the extreme northern territories of the Arctic and become complicated toward the south.

Summary

A soils map of the Arctic has been compiled (including the arctic and tundra regions of the northern hemisphere and the adjacent parts of the taiga zone) at a scale of one-to-ten million. The map shows the predominant soils and shows their zonal and facies characteristics and the structure of the soil cover. The component composition of the soil cover and microcombinations (soil complexes and nanocomplexes) are determined primarily by bioclimatic conditions. It is possible to discriminate seven genetic-geometric forms of microcombinations (jointed-nanopolygonal, heaved-hummocked, and others). The mesostructure of the soil cover (combinations and mosaics) is determined primarily by the lithological-geomorphological characteristics of the territory. It was possible to define 14 genetic-geometric forms of mesostructures (linear-dendritic erosional, rounded-spotty depression structures, etc.).

The map content is supplemented and expanded by regionalization, by diagrams of soil profiles and complexes and an analytical description of the soils.